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**NOAA-OGP Visiting Scientist Position at Potsdam Institute for Climate Impact Research
Progress Report Covering the Period 1 June 2002 — 14 April 2003**

Overview

From the beginning, the work that is the subject of this progress report has had two distinct objectives. First, by working at PIK, one of the leading institutes for climate change impact and vulnerability research, to conduct the best possible basic social-science on the relationship between human decision-making patterns (behavioral economics) and vulnerability to climate change. Second, to work to build linkages between research ongoing at PIK and that taking place in the United States, particularly with respect to the NOAA funded research projects on science and technology for sustainability (SUST), ongoing at Harvard and elsewhere. At the same time, I was to continue with a pre-existing research project—Examining the Ability of Subsistence Farmers in Zimbabwe to Use Seasonal Climate Forecast Information—also funded by NOAA-OGP, and explore linkages between that project and other work ongoing at PIK and within the SUST group of projects.

Towards these ends, I have engaged in several inter-related areas of work. In the basic research area, I have initiated a research project with four other researchers at PIK—Multi-Agent Adaptation (Magenta)—in which we seek to explore the linkages between individual decision-making patterns and societal adaptive capacity, primarily through the use of agent-based computer modeling and analysis. In addition, I have begun work on a joint research project with a SUST researcher, Dr. David Cash, on factors affecting people's decisions to take adaptive measures, as a function of the ways in which people receive information about those measures. In terms of building linkages, I initiated the organization of a workshop at Harvard University in October 2002, attended by myself and one other PIK researcher (Dr. Dagmar Schröter) and several American scholars (most notably Dr. Colin Polsky, a NOAA post-doc fellow, in which we developed a common methodology for vulnerability research. I have also organized a panel session for Open Meeting of the Human Dimensions of Global Environmental Change Research Community, to take place in Montreal in October, with participants from PIK, the US, and Canada. In terms of the Zimbabwe project, I have continued along the original work plan, and have extended it to include collaboration with scholars from Harvard (Dr. David Cash, Jonathan Borck) and the Tyndall Centre in the UK (Dr. Gina Ziervogel, Dr. Emma Archer). I discuss each of these efforts in greater detail below. I then list the papers I have written while at PIK, as well as the conferences, workshops, and presentations where I have spoken.

Work Areas

Magenta

The Magenta project builds on the supposition that adaptation to climate change at the societal level is intimately tied to the ways in which people make decisions at the individual level, and that to understand the former it is necessary to explore the latter. For example, it has long been observed that people overestimate the likelihood of low-probability events, and underestimate the likelihood of high-probability events, and that this in turn biases their decision-making in ways that are counter-productive with respect to minimizing the net risks that they face in life at the lowest possible cost. How, then, would this individual decision-making bias upscale to into a community's decision about how to respond to particular risks associated with climate change,

such as the flooding of low-lying areas? We suggest that insights can be gained from computer modeling in an agent-based format, insights such as whether individual biases build on each other, or cancel each other out, when operating in a social situation. To explore this, we have assembled a five member research team—myself, as project leader, with a specialty in behavioral economics; Dr. Richard Klein, a geographer specializing in adaptive capacity research; Dr. Lilibeth Acosta-Michlik, an economist specializing in equilibrium modeling; Dr. Bernd Siebenhüner, an economist specializing in group decision-making; Jochen Hinkel, an ecologist specializing in object-oriented modeling; and, Robert Marschinski, a political scientist specializing in agent-based social simulation.

Work has been slow but steady, with two major accomplishments to date. First, we have undertaken a computer modeling exercise examining the relationship between present-biased discounting (treating the present not only as more important than but also as qualitatively different from the future, relative to all future periods)—a robust observation in the behavioral economics literature—and societal decisions with respect to resource exploitation and use. We did indeed gain some valuable insights, with relevance for natural resource markets and in particular developing countries participating in these markets, and have submitted a paper to *Ecological Economics*. Though this was not on-point with respect to climate change adaptation, it was an interesting first attempt at up-scaling a particular individual decision-making bias. Second, we have started to collaborate with Dr. Horst Sterr of the University of Kiel in a project examining decision-making in coastal communities of northern Germany, particularly with respect to the decision to allow low-lying farmland to revert to salt-water marshes as sea levels rise. We submitted a pre-proposal to the German Ministry for Education and Research, which was approved (two approved out of sixteen submitted). We are in the process of building the first computer model of the social dilemma that intentional flooding—a potentially important adaptation to climate change—presents.

Trust and Adaptation

With Dr. David Cash, a SUST researcher, as well as Dr. Hannah Riley, a Harvard University assistant professor, I have worked on a line of research examining the factors that influence people's trust in scientific and technical information. This is highly relevant for adaptive capacity research, in that it examines the likelihood that people will make use of scientific information about climate change to change their behavior. In particular, we are examining how the relationship between the decision-maker and the communicator of the information, the prior accuracy of the information, and the manner in which the information is communicated affect that trust. Our particular research is highly empirical, in that we are using an experimental economics methodology, involving actual human subjects participating in a controlled experiment. During my most recent trip to Zimbabwe, I conducted the experiment with over 200 test subjects, with results that promise to be both informative and statistically significant. The three of us are currently in the process of analyzing these data, and will shortly begin to draft a paper for journal submission based on the results.

Vulnerability Assessment Methods Workshop and Paper

In October 2002, I planned to visit Harvard University, in order to meet with Dr. William Clark and others to explore linkages between Harvard and PIK vulnerability research. To make best use of this time, I explored with Dr. Colin Polsky the idea of organizing a small workshop in which we could discuss a particular set of ideas: how to go about assessing vulnerability and adaptive capacity. That workshop perked the interest of Dr. Dagmar Schröter, a PIK scholar, and the three of us eventually organized the workshop together. Unfortunately, scheduling conflicts prevented

two of the people we had hoped would attend—Bill Clark and Mike Hall—from attending. Nevertheless, the workshop proved to be very interesting, bringing together researchers from PIK, Harvard, Penn State, Clark University, the University of Colorado, the Stockholm Environment Institute, the Worldwatch Institute, Columbia University, and MIT, for two days of lively discussion. From this workshop Colin Polsky, Dagmar Schröter, and I have written a paper. It is currently being published as a discussion paper at Harvard's Kennedy School, and we plan to shorten and refine it, after comments, for journal submission.

Open Meeting Panel Session

One of the most important academic conferences among social scientists examining climate change vulnerability is the bi-annual Open Meeting of the Human Dimensions of Global Environmental Change Research Community. The next of these will take place in Montreal in October. To try to build research linkages across the Atlantic, I have organized a panel session, Theoretical Perspectives on Adaptive Capacity. The panelists include: Cynthia Neudoerffer, David Waltner-Toews, and Barry Smitt from the University of Guelph, Ontario; Colin Polsky from Harvard / Clark University; and Lilibeth Acosta-Michlik, Richard Klein, Dagmar Schröter, and Torsten Grothman from PIK. Hopefully the abstracts for the session and for the individual papers will be accepted. In any event, we have begun a lively discussion among us, and are hoping to explore continuing collaboration.

Zimbabwe Project

This project examines the conditions under which subsistence farmers in Zimbabwe can and will use seasonal climate forecasts to support decision-making. It is funded by the NOAA-OGP Human Dimensions program, administered through Boston University. In addition to my work, the project supports one Boston University graduate student, Pablo Suarez, and a collaborator at the University of Zimbabwe, Chiedza Gwata. As per the project work plan, I traveled to Zimbabwe in September 2002, where I attended the Southern African Regional Climate Outlook Forum, and also organized the project-specific local climate stakeholder workshops. I traveled again to Zimbabwe in April 2003, where Pablo, Chiedza, and I organized the administration of a household survey. During this trip, I also conducted the experiment that I developed with David Cash and Hannah Riley of Harvard, with the assistance of Pablo Suarez.

This year we have worked hard to build linkages between this project and other research projects in southern Africa, mainly South Africa. First, in January 2003, I traveled to South Africa for this purpose. There, I met with Drs. Emma Archer and Gina Ziervogel, both at the University of Cape Town, and visited their field study site in the Limpopo Province. They are engaging in research funded by NOAA-OGP, the Tyndall Centre in the UK, and the Stockholm Environmental Institute, exploring adaptive capacity among small-scale commercial farmers. The three of us standardized our survey instrument, to allow for cross-country comparisons, both with respect to climate forecast use and to indicators of adaptive capacity. I invited their collaboration in a PIK and EU sponsored project, Development and Climate, which seeks to find overlaps between efforts at sustainable development and climate change adaptation and mitigation. Second, I have worked with David Cash and Jonathan Borck of Harvard University on a paper that compares climate forecast applications in southern Africa and the Pacific islands. This will be ready for journal submission shortly. Third, my research assistant Pablo Suarez, at my suggestions, has begun to work with Dr. Jesse Ribot from the Worldwatch Institute on a paper examining information use and public participation. We had originally met Jesse when he attended the October workshop at Harvard University, which I organized with Colin Polsky and Dagmar Schröter.

Miscellaneous Work at PIK

Needless to say, there is a long list of other work I have done as an active researcher at PIK, including the following:

- I have been attending and contributing to meeting in the Global Change and Social Systems department, the Risk, Management, and Politics research platform, and the Environmental Vulnerability Assessment research group.
- In November, I was asked to represent PIK at a conference in Cologne exploring linkages between climate change policies and the financial services sector, which led to a subsequent visit to a financial services firm in Zürich.
- In December I helped with the organization of a German Political Science Association conference on the human dimensions of global change.
- I am part of the Development and Climate project, for which I have traveled to the Netherlands for meetings, and have upcoming meetings in South Africa and Denmark.
- In March, I assisted with the preparation of a 12 million € proposal by PIK to the European Union, to fund a multi-institute project examining long-term adaptation and mitigation strategies for climate change.

Papers Written/Revised While at PIK

- Cash, David, Jonathan Borck, and Anthony Patt (in preparation). Institutions for linking research to decisions: a comparative analysis of ENSO forecasting systems.
- Polsky, Colin, Dagmar Schröter, and Anthony Patt (in preparation). Assessing global change vulnerability: purposes, elements, and processes.
- Suarez, Pablo and Anthony Patt (in preparation). Caution, cognition, and credibility: the risks of climate forecast application.
- Patt, Anthony, Pablo Suarez, and Robert Marschinski (in review). Resource extraction with quasi-hyperbolic discounting. In review at *Ecological Economics*.
- Patt, Anthony and Daniel Schrag (in press). Using specific language to describe risk and probability. In press at *Climatic Change*.

Presentations and Workshops While at PIK

- *Association of American Geographers, 2003 Annual Meeting*, New Orleans, USA, March 2003. Presentation: “Building relationships of trust in forecast communication: lessons from Zimbabwe.”
- *Swiss Federal Institute for Environmental Science and Technology*, Zürich, Switzerland, February 2003. Presentation: “Present-biased behavior, resource use, and agent-based modeling.”

- *Sustainable Asset Management*, Zürich, Switzerland, February 2003. Presentation: "Behavioral economic predictors of unsustainable investment."
- *2002 TOPIK Days*, Potsdam Institute for Climate Impact Research, Potsdam, Germany, December 2002. Presentation: "Magenta: Modeling Agents' Adaptation."
- *Berlin Conference on the Human Dimensions of Global Environmental Change*, Berlin, Germany, December 2002. Presentation: "Too Much Caution? Forecast Communication in Zimbabwe." Session moderator.
- *K.E.R.N. Project Research Group, Christian Albrecht Universität*, Kiel, Germany, November 2002. Presentation: "Agent-based modeling of adaptive capacity."
- *Expert Workshop on Climate Change and the Financial Sector*, Cologne, Germany, November 2002. Invited participant.
- *Human Dimensions of Global Change Principal Investigators Meeting*, Seabrook Island, South Carolina, USA, October 2002. Poster presentation: "Participatory Forecast Application Pilot Project." Session moderator.
- *Vulnerability Methods and Models Workshop*, Cambridge, Massachusetts, USA, October 2002. Co-organizer, rapporteur, and presenter: "Agent Based Analysis of Adaptive Capacity."
- *National Oceanic and Atmospheric Administration Office of Global Programs*, Silver Spring, Maryland, USA, October 2002. Presentation: "Adapting to Climate Change in an Imperfect World."
- *Workshops on El Niño, Climate Prediction, and Farming Decisions*, Mahkwe, Tiya, Mafa, and Mkoka, Zimbabwe, September 2002. Organizer and facilitator for workshops relating seasonal climate forecasts to local decision-making.
- *Southern African Regional Climate Outlook Forum*, Harare, Zimbabwe, September 2002. Invited participant.
- *National Institute for Public Health and the Environment*, Bilthoven, The Netherlands, September 2002. Presentation: "Adapting to Inter-annual Climate Variability."
- *Potsdam Institute for Climate Impact Research PIRSIQ Seminar Series*, Potsdam, Germany, August 2002. Presentation: "Translating Language and Numbers to Describe Climate Change Risks."
- *Potsdam Institute for Climate Impact Research EVA Seminar Series*, Potsdam, Germany, August 2002. Presentation: "Assessing and Communicating Drought Vulnerability in Rural Zimbabwe."
- *Multi Agent Modeling of Adaptation Vision Factory*, Potsdam, Germany, August 2002. Workshop organizer and presenter of project proposal.

- *Integrated Disaster Risk Management Conference*, Laxenburg, Austria, July 2002.
Presentations: “Responding to Climate Induced Risks in Zimbabwe” and “Assessing and Communicating Probabilities Associated with Climate Change.” Session rapporteur.

Conclusion and General Comments

The work at PIK has been busy, at times hectic, although that is standard for academic research. Overall, I am very pleased with my progress in terms of basic research and writing with respect to vulnerability and adaptation. Having been able to organize the Magenta project “from scratch”, while participating actively in several others, with a large number of papers, presentations, and workshops, has exceeded my expectations of my abilities. What has been less successful, so far, is the attempt to link research at PIK and that taking place in the US. My efforts have brought some results, though little that is concrete. I look forward to the Montreal conference in October as a way to bring researchers together, and plan to work to turn our panel session into the starting point for a larger piece of work, such as a special journal issue. Additionally, there is the possibility to travel extensively to the Tyndall Centre in the UK this coming summer, so as to organize a major workshop there. Both of these should lead to some more concrete results.

Finally, this has been an exceptionally interesting time to be living as an American in Germany. There is a large and growing sentiment in Germany against the United States and its government. As a representative at PIK of the US government, I have felt a special responsibility to stay informed of US, German, and world politics, and to participate carefully and thoughtfully in discussions with colleagues and friends. Doing so, of course, has required me to become fluent in German, both in order to read the German press on a daily basis, and in order to participate in complex conversation while showing respect to my host country. This in and of itself has been both a difficult and rewarding challenge. I look forward to a second year in Germany and at PIK, and both the challenges and opportunities this shall bring.